The FNPL Photoinjector & SRF R&D

H Edwards AAC Nov 03

Topics:	Speakers:
The FNPL Injector Program	Philippe Piot*
Superconducting RF R&D	Leo Bellantoni**
SRF Materials Research	Pierre Bauer*
Cold gun R&D (for polarized e-)	Markus Huening*

* Peoples Fellows

** Staff Physicist, Particle Physics Division

These activities are to bring to FNAL connection with and experience in concepts and technologies of the future. They have a strong link to LC's, proton drivers, collaboration.

The FNPL Photoinjector & SRF

The connections: SRF technology, LC's (e's), Proton Drivers, TESLA, FEL research, AARD, Students, Collaborations

The Charge:

- Are the goals well defined and targeted?
- Are the goals appropriate within the context of Fermilab future & US HEP?
- Are the resources adequate to support the goals?
- If not, what is the committees views?

My impressions:

- The goals are to bring to FNAL connection with and experience in future concepts and technologies beyond its present program and to give opportunity for bright young people. (investment for future)

- Yes, But Also accelerator R&D bridges many end use applications and should not be closely confined. Its strength is in interplay of ideas irrespective of final application.

- The goals are (and should be) ambitious; resources are marginal at present though not insignificant. Considerable progress has been made. But resources would need to be increased to enlarge the effort.

- This is the time for aggressive Acc R&D programs - future projects are uncertain.

Motivation- Seed activities for the Future

The Photoinjector & the SRF Activities give FNAL an introduction to and experience with important areas of accelerator physics and technology.

SRF is an enabling technology of the future- Experience and expertise in it will payoff as the lab thinks about future directions.

The photoinjector is an instrument by which the srf is applied to real beam operations. It brings a much needed Lab connection to AARD physics.

The photoinjector is a research tool for development of low emittance, high space charge, and high charge beams.

It is a platform for advanced accelerator concepts and diagnostics development.

The activities are strongly connected to collaborative efforts and student involvement.

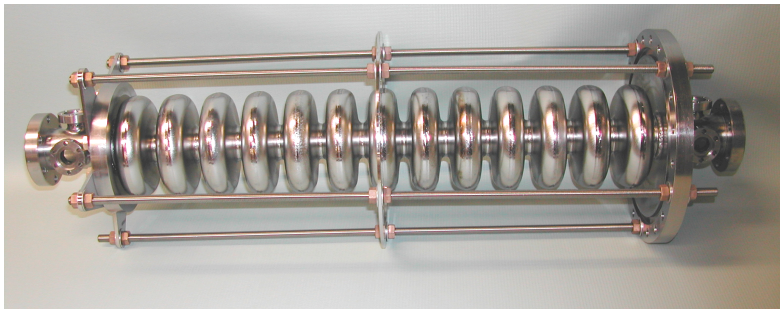
SRF R&D- (joint BD & TD activity)

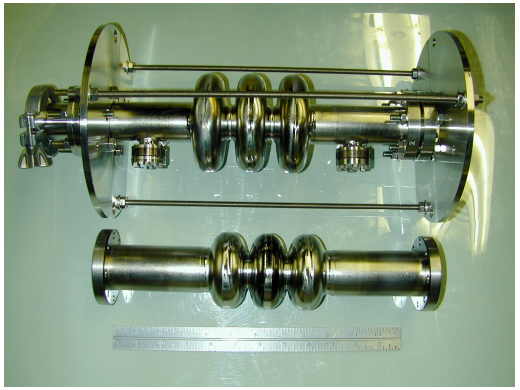
An initial start toward gaining proficiency and expertise-

This effort is hopefully just a start toward greater activities (LC, proton driver)

Design/development work has been at 3.9GHz- CKM deflecting mode,
3rdHar(of 1.3GHz) accelerating mode

Operational experience with 1.3GHz TESLA cavity - install and operate in Photoinjector

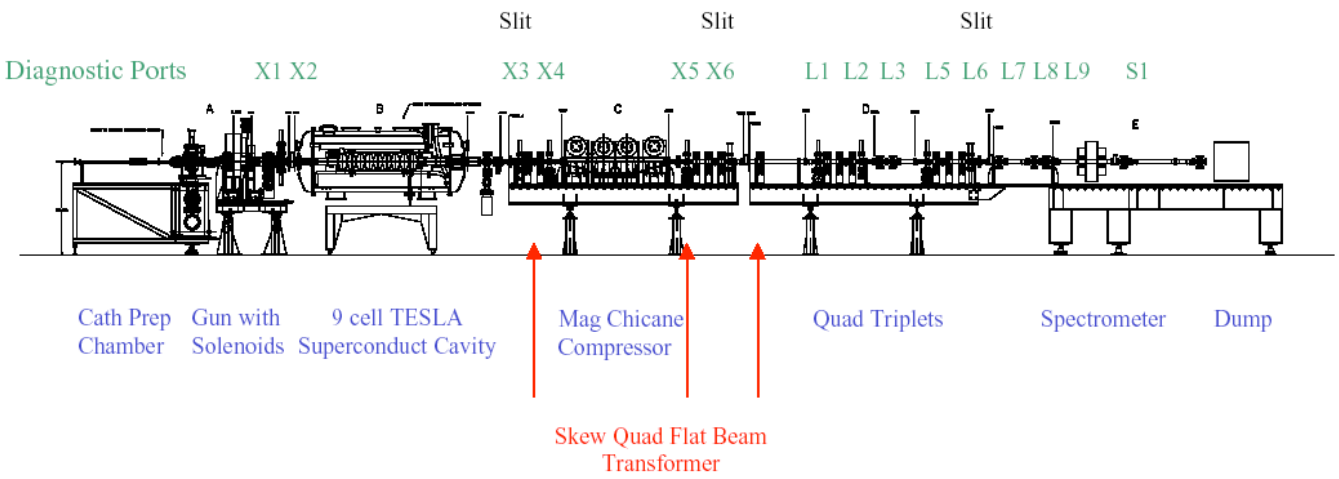


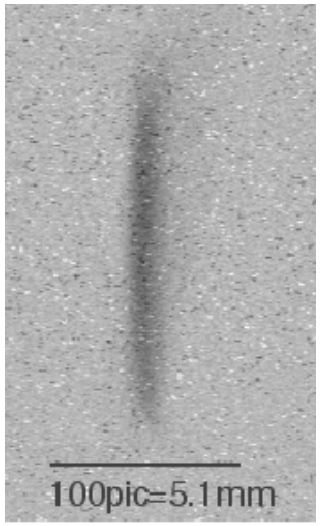


3.9GHz prototypes will be installed and operated in FNPL injector.

Collaboration-

- Hi gradient TESLA cavity considered for installation at FNPL
- 4 cavity 3rdHar module under consideration for TTF





Flat Beam Exp

Present PhotoInjector using TESLA cavity ~15MeV

Flat Beam (new beam dynamics)

Space charge beams (learn to control and compensate), low emittance

Operation of SRF system (experience)

Upgrade Plan

Install 3 new SRF cavities: Hi Gradient TESLA, CKM, 3rdHar

- Increase energy to ~40-50 MeV,

LRPC R&D Evolution Plans & Steps (multi year) (1)

The main steps of the integrated program are:

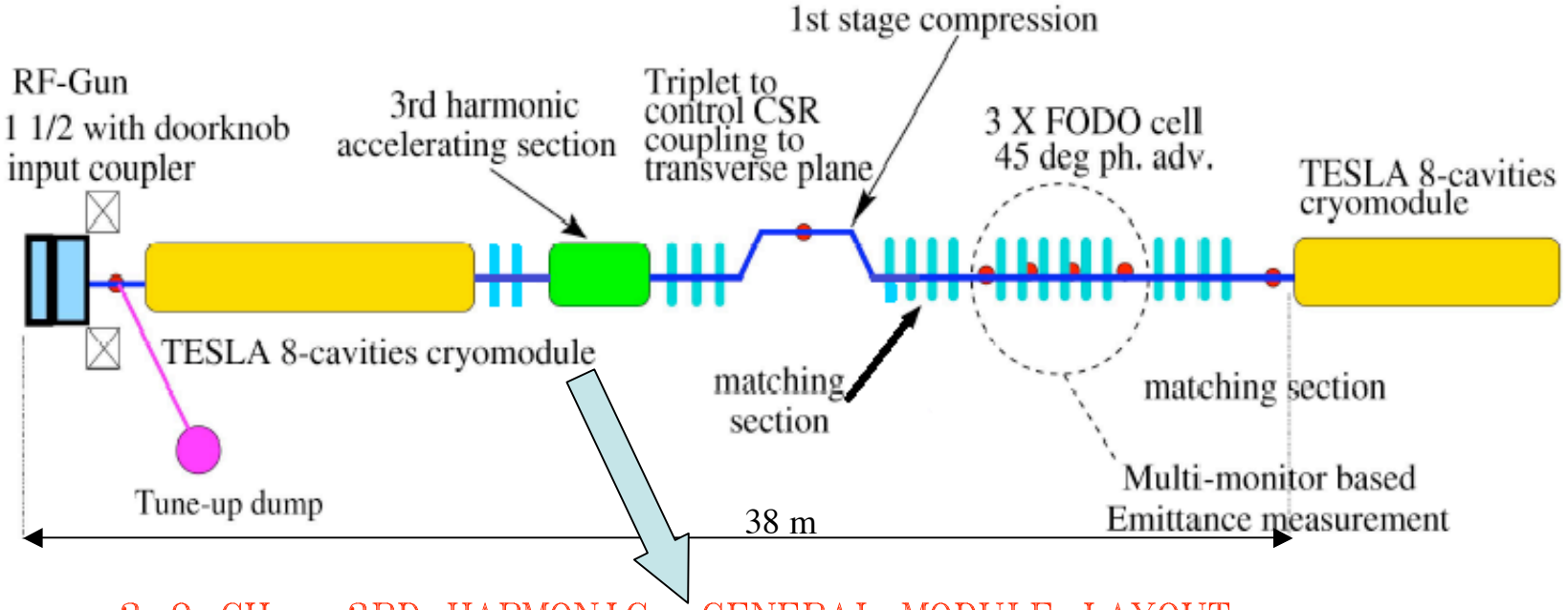
1) Upgrade FNPL at A0 with a high gradient 1.3GHz srf cavity to provide up to 40-50 MeV beam energy. Operational test of high gradient cavity with beam.

2) Install in FNPL two 3.9GHz srf cavities (a transverse mode cavity, and a field linearization cavity). This tests both the srf development and leads to diagnostic and emittance tools.

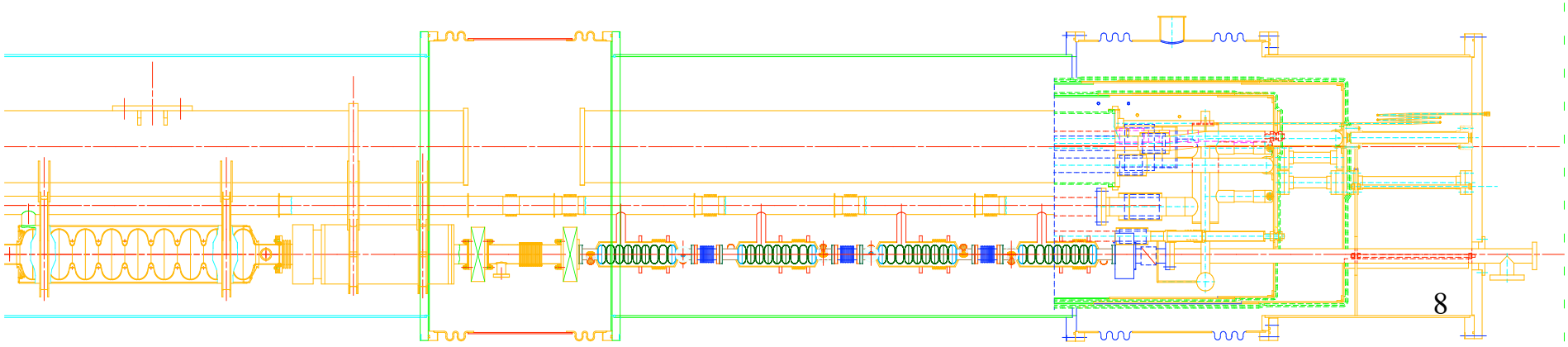
3) Build a 3.9GHz srf four cavity module for the TTF collaboration. This provides important emittance, bunch length reduction capability to TTF. It also through the collaborative effort with DESY provides full technology transfer of srf design & engineering to Fermilab.

Step3 MOU(draft) with DESY-TTF Injector III with 3rd Harmonic Cavities

Demonstration of FNAL developing expertize in SRF



3.9 GHz, 3RD HARMONIC, GENERAL MODULE LAYOUT



Evolution Plans & Steps- (2)continued

4) Further develop srf infrastructure for activities beyond the present capability. Specifically a 2K cryoplant is needed. Time scale is ~ 3years. Materials development and collaboration with materials experts (Univ Wisc) is also a goal.

5) Develop and implement a collaborative proposal for a srf test bed beyond the A0 capabilities. This test bed would attempt to integrate the needs of many US labs for proving state of the art srf performance, both high gradient and high Q in multi cavity modules with e beam energies > 100MeV. It in parallel provides beam for further beam emittance, diagnostics, and AARD (e.g. plasma, laser) studies.

Steps: -Can labs agree (unite) on need and a proposal (e.g. ANL, Cornell, JLab, LBL, SNS, MS…)

-Can funding agencies agree across agencies & divisions (e.g. NSF, DOE-BES,NP,HEP

-Location is secondary to the above steps.

Collaboration

Collaboration is an extremely important aspect of the activities. It is what keeps us connected.

NIU/NICADD- FNPL Program, postdocs, funds
DESY TESLA TTF-srf, e injector, FEL applications, postdocs
Rochester- laser expertise, and students
UCLA- plasma acceleration, students
Chicago- student- flatbeam
LBL-LUX Much common R&D interest: flat beams, srf transverse mode, and acc mode 3.9GHz.
Argonne, MSU- srf infrastructure, chemistry
Cornell & JLab- srf, information, assistance,
Univ Wisc- basic surface studies
INFN, Saclay, Orsay IPN - cathode, modulator, cryostat(hi grad)
Georgia- diagnostics

FNPL Photoinjector Students, Postdocs, Fellows

Students:

Fry	Rochester
Fitch	Rochester
Colby	UCLA
Carneiro	Orsay-Paris
Fritzler	Darmstadt
Yin E Sun*	Chicago
Tikhoplav*	Rochester
Thompson*	UCLA
Bollinger*	NIU

Postdocs:

Colby	FNAL
Hartung	FNAL
Barov*	UCLA/NIU
Desler*	DESY
Mihalcea*	NIU

Peoples Fellows:

Piot*

Huening*

* In progress, present

Approximate Effort/Resources FY03
FNPL, SRF

	M&S($K)	FTE
FNPL*	150	6.0
SRF BD	490	5.5
SRF TD	680	8.5

* Does not include NIU